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EFFECT OF SEXUAL EXPERIENCE ON MALE MATING SUCCESS IN A LEK FORMING TEPHRITID *ANASTREPHA SUSPENSA* (LOEW)[1]

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ABSTRACT

Recently mated *Anastrepha suspensa* (Loew) males are less likely to copulate than virgin rivals when placed in competition. This effect is lost after 2 h. Mated males are as active as virgins in sexual advertising and the lack of mated male success appears to be due to female rejection. Females may be discriminating against males made relatively infertile through exhaustion of accessory gland fluids. Postcopula male unattractiveness

[1]Diptera: Tephritidae.
[2]Employed through a cooperative agreement between the Department of Entomology and Nematology, University of Florida and the Insect Attractants, Behavior, and Basic Biology Research Laboratory, Gainesville.

might decrease the expected high variance in male sexual success associated with lekking species.

RESUMEN

Cuando están puestos en la competencia, los machos apareados de *Anastrepha suspensa* tienen menos probabilidad de copularse que rivales virgenes. Se pierde este efecto despues de 2 horas. Los machos apareados están tan activos en la ostentación sexual como los machos virgenes y la falta de éxito de los machos apareados parece ser por causa del rechazamiento de ellos por las hembras. Puede ser que las hembras discriminan en contra de los machos los cuales vuelven relativamente infertil por el agotamiento de los fluidos de la glandula accessoria. La falta de atractividad de los machos despues de copularse podría rebajar la varianza alta esperada en los éxitos de los machos que está asociada con las especies las cuales utilizan los *leks*.

Male investment in gametes and associated fluids is often considered negligible. However, sufficient energy and material can be expended in copulation to realistically limit a male's sexual success (Dewsbury 1982). Females recognize these periods of relative infertility and discriminate against recently mated males in a fish, the lemon tetra, *Hyphessobyrcon pulchripinnis* Ahl (Nakatsuru and Kramer 1982), and an acalypterate fly, *Drosophila melanogaster* (L) (Markow et al. 1978). In the latter, males regain their attractiveness within 24 h, apparently upon the refilling of the accessory glands whose products are necessary for the transferal of sperm (see Lefevre and Jonsson 1962). Females recognize freshly mated males by scent (Markow 1984).

Caribbean fruit flies, *Anastrepha suspensa* (Loew), copulate within male aggregations (leks) (Dodson 1982, Burk 1983). This is a mating system believed to have evolved through selection exerted by choosing females and is generally considered to generate large variances in male reproductive success (Alexander 1975, Bradbury 1981). That is, if females can more accurately and cheaply compare males that are close to one another, they may prefer to choose mates from high male density "spots." If so, males will in turn be selected to aggregate. Assuming females have similar criteria for judging male quality, then the convenience of having many potential mates together should result in a small percentage of males acquiring the majority of copulations. Depending on female arrival rates in leks, a postcopula decline in male attractiveness could tend to reduce the expected differences in male sexual success.

Evidence is presented here that recently mated male caribflies are in fact less likely to mate than virgin rivals; that even males that would normally be preferred because of their large size are relatively unsuccessful if freshly mated, and that their failure may be due to female rejection rather than a loss of courting vigor.

METHODS

Flies were removed as 1- to 3-day-old virgins from laboratory colonies. After reaching sexual maturity (10 to 12 days of age) they were placed in 7.5 cm x 7.5 cm screen wire cylinders for observation.

To determine if virgin or experienced males are more likely to mate, one of each type was placed with a virgin female and sexual activity was recorded for an hour. As soon as copulation occurred the flies were taken aside for weighing. Male virgins were always the smaller of the 2 competitors. This minimized the possibility of confusing the attractiveness of virginity with the appeal of size. Normally, females overwhelmingly prefer bigger males as mates (Burk and Webb 1983). Experienced males had had their sexual encounters: 1) immediately prior to introduction (n = 33), 2) 2 h earlier (n = 20), and 3) 24 h earlier (n = 21). These various passages of time allowed estimation of how long any postcopula effect on sexual success endures.

Since failure to mate may be due to female rejection or male disability, the sexual vigor of recently mated males was estimated through their acoustic behavior. Males sexually advertise by beating their wings to produce an attractive calling song that consists of repeated ∽ 1/2-sec pulse trains (bursts) (Webb et al. 1983). The pulse trains produced by 3 caged males were counted for both virgin males and just previously mated males during alternating 5-min periods for 1 h. A total of 9 cages of each type were observed.

Results

Unmated males are more likely to copulate than experienced rivals that have just completed coupling ($X^2 = 8.8$, $p < 0.005$) (Fig. 1). This difference is especially noteworthy when the smaller size of the virgins is noted ($\bar{X} = 8.1$ mg *vs.* $\bar{X} = 10.2$ mg or 79% the weight of their competitors). Larger males are generally more sexually successful (Burk and Webb 1983). After 2 h, the advantage of inexperience is lost and after 24 h, clearly reversed ($X^2 = 5.8$, $p < 0.025$). The typical pattern of large male success is clearly established (male sizes were as follows: 2 h, 9.5 mg *vs.* 12.4 mg; 24 h, 6.8 *vs.* 9.6 mg).

Recently mated males are statistically as sexually vigorous as the unmated males. Their solicitation of sex *via* acoustic advertisement occurs at a similar rate (just mated males 0.20 pulse trains/fly per min *vs.* virgin males 0.15 pulse trains/fly per min). Mated males produced more pulse trains in 14 of 24 adjacent observation periods.

Discussion

The cause of freshly mated male rejection is unknown. However, the ∽ 2-h long recovery of attractiveness is similar to the time required to recharge accessory glands in another acalypterate fly (*D. melanogaster*, Markow et al 1978). Females are presumably avoiding less fertile mates.

It is interesting that females would trade mate size for time. Keeping in mind the artificiality of the conditions, the value of providing a big father for one's offspring would appear to be less than a 2-h wait. The mean duration of leks in the field is unknown, although in theory they could last throughout an afternoon. If durations are often only a few hours, perhaps the choice of a smaller male is better than a day's wait and a chance at a larger mate.

Postcopula unattractiveness could influence sterile male release techniques for control of *A. suspensa* and perhaps other tephritids. If operational

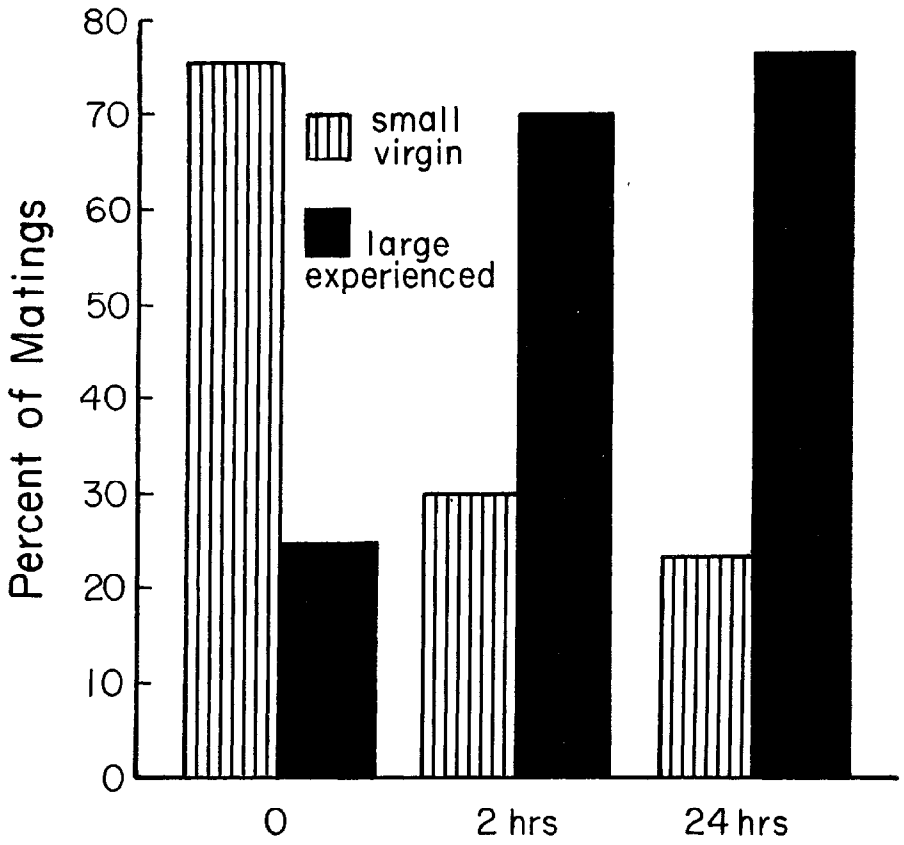

Fig. 1. The percentage of unmated males (white bars) and recently mated males (black bars) that copulate. Recently mated males (0) had their previous copulation immediately prior, n = 33; 2 h previously, n = 20 and 24 h previously n = 21.

sex ratios (available males: receptive females) are highly male biased and "wild" females arrive infrequently at leks, then variances in male reproductive success may be high. But as female arrival rates increase, for example, with a sterile release, the variance of male reproductive success should decline, i.e. what was a very attractive male to the first female becomes less so to those that follow.

In conditions where "wild" males are generally more successful, the release of sterile females along with sterile males might tend to blunt any edge the "wild" ones have in prolonged sexual competitions. When overflooding ratios still allow a reasonable chance of fertile individuals having sexual encounters, then plans to remove sterile female fruit flies from release groups might be ill-founded. How general such conditions might be remains to be determined.

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SURVEY OF *HELIOTHIS* SPP. LARVAE FOUND ON FLORIDA BEGGARWEED AND POSTHARVEST TOBACCO IN FLORIDA

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ABSTRACT

Heliothis spp. larvae were collected from pre- and postharvest tobacco and Florida Beggarweed, *Desmodium tortuosum*. Five distinct adult *H. virescens* peaks were determined from pheromone-baited cone traps, but only 4 larval *Heliothis* spp. peaks followed them. The late July larval

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